OPERATING MANUAL CHANGES

MANUAL IDENTIFICATION

Model Number: HP Model 64000
Manual Title: System Overview
Part Number: 64980-90903
Date Printed: November 1979

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after the printing of the manual.

To use this supplement:
Make all ERRATA corrections.
Make all appropriate software or hardware related changes indicated in the table below.

Software		Hardware	Make Manual Changes
Model - Rev.	Date	Serial Prefix or Number	

▲ NEW ITEM

CHANGE 1

Page 11-1, Introduction:
Add the following paragraph after the first paragraph on the page.

CAUTION

Before applying or removing system power, make certain there are no PROMs or other devices installed in any of the module sockets. To do otherwise may cause damage to the device or may alter its program.

▲CHANGE 2

Insert the attached procedure between pages 2-18 and 2-19 in the manual.

NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

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SOFTWARE UPDATING PROCEDURE

This procedure should be used to update system software after user-generated files have been stored on the disc and when Performance Verification is not required.

For loading software on a new system, refer to the paragraphs entitled "Boot-Up" and "Performance Verification". The boot-up procedure involves reformatting the disc. Since reformatting destroys all files on the disc, the following procedure eliminates disc reformatting (along with the Performance Verification, which is assumed to be unnecessary).

CAUTION

To ensure that user-generated files are not accidentally destroyed (by reformatting the disc), they should be backed up on tape cartridge.

CAUTION

This caution note applies only to systems with Model 7906 Disc Drives: See figure 2-24. You must determine whether your disc is formatted as an "entire" logical unit (LU) or as two logical units. Figure 2-24 shows a display indicating LU=0 for an "entire" logical unit. For discs formatted as two logical units, the display will indicate LU=0, LU=1. (This display can be generated by cycling the power at any station off and back on.)

PROCEDURE:

a. Set System Control Source switches to LOCAL MASS STORAGE (10).

b. Check contents of Software Update Kit (supplied by HP). If the kit does not contain an Operating System Tape, omit steps e and f.

c. Insert Operating System (or other) tape in front-panel tape drive slot of the master controller development station.

d. With development system power on, hold SHIFT key down and press RESET key once. Tape light should come on and display should indicate BOOT IN PROGRESS; if not, cycle station power off and back on.

NOTE

Step e applies only to systems with a Model 7906 Disc Drive. It must be determined whether the 7906 is formatted for one or two LU's.

e. On systems with a Model 7906 Disc Drive, display should be as shown in figure 2-22. If 7906 is formatted as LU=0, LU=1, press soft key labeled "upper"; otherwise, press "entire".

f. For all systems, select soft-key answers to the following questions as they are displayed sequentially on the screen:

Question: TEST TIME IN MINUTES?
Answer: no__test.

CAUTION

For the next question, do not press the "yes" soft key unless you wish to reformat the disc. To do so will destroy all files currently on the disc and will reformat the disc.

Question: DO YOU WANT TO FORMAT?
Answer: no

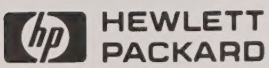
Question: DO YOU WANT TO LOAD THE SYSTEM SOFTWARE CONTAINED ON THIS TAPE CARTRIDGE?
Answer: yes

NOTE

When tape load is complete, system "software load complete" message should be displayed on the screen.

g. Insert other tape (if provided) in tape drive; tape should begin booting automatically and BOOT IN PROGRESS message should appear on screen. (Repeat this step for each additional tape.)

h. When all tape loading is complete, remove tape cartridge and reset System Control Source Switches to 00, SYSTEM BUS (DISC); normal operation is now automatically resumed.



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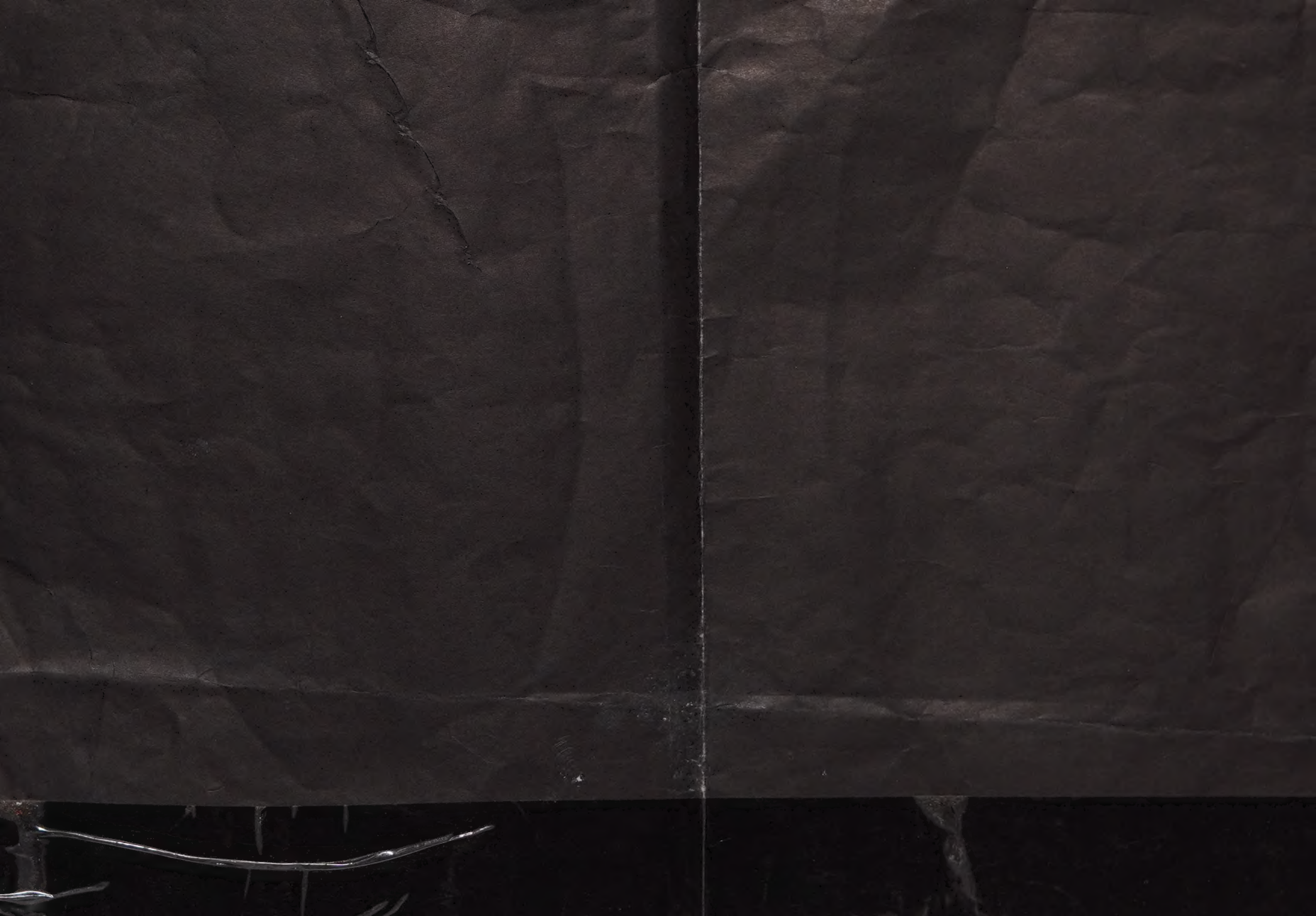

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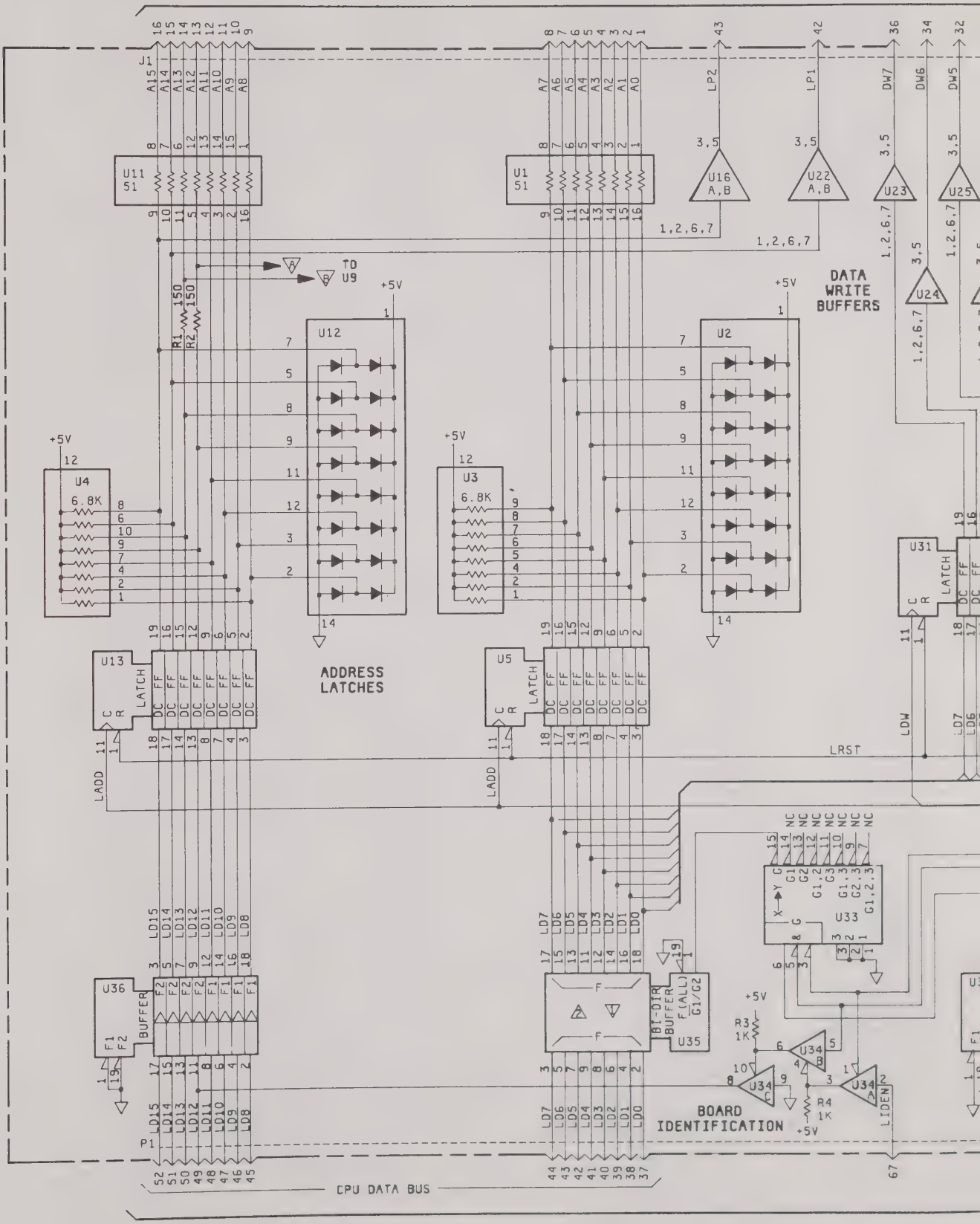
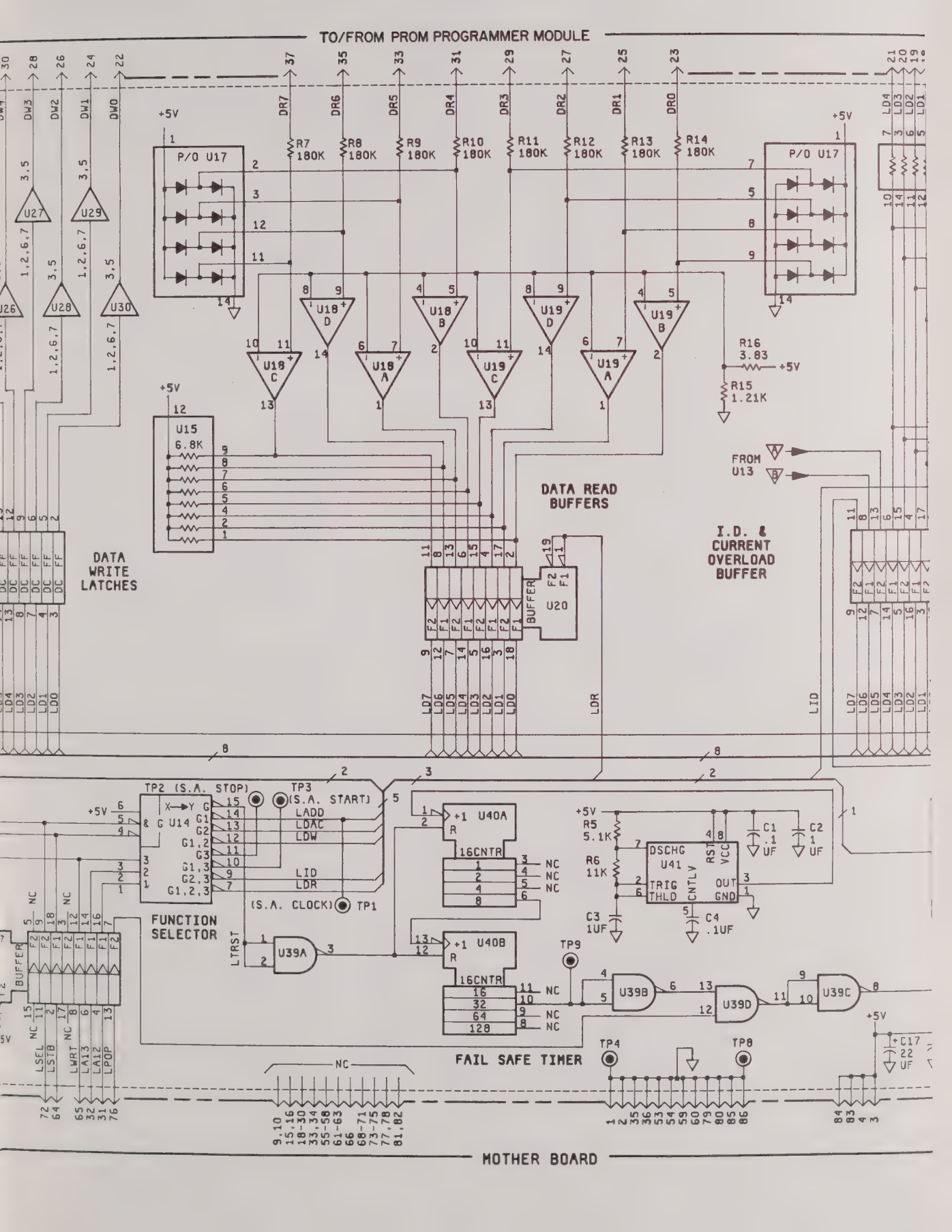
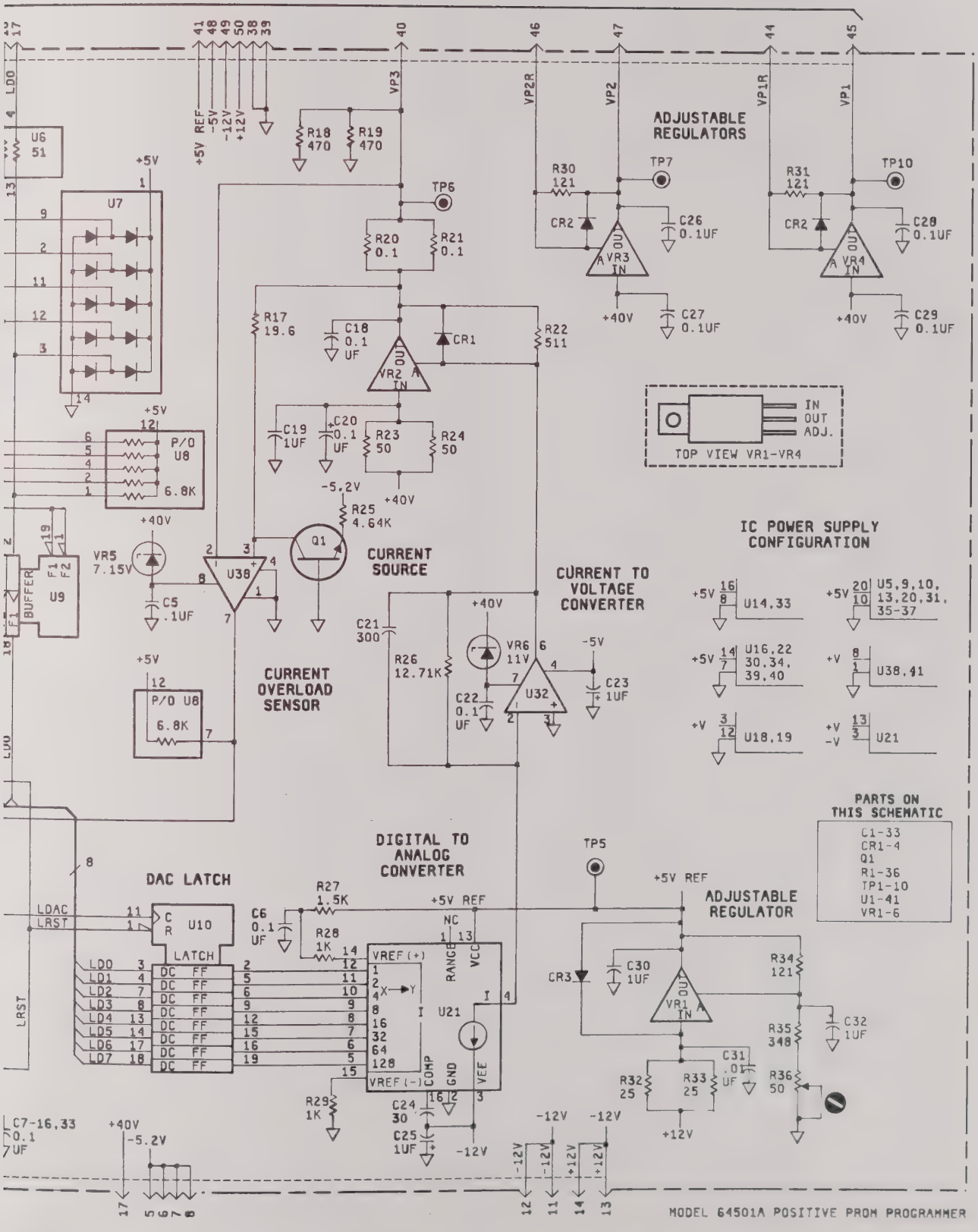
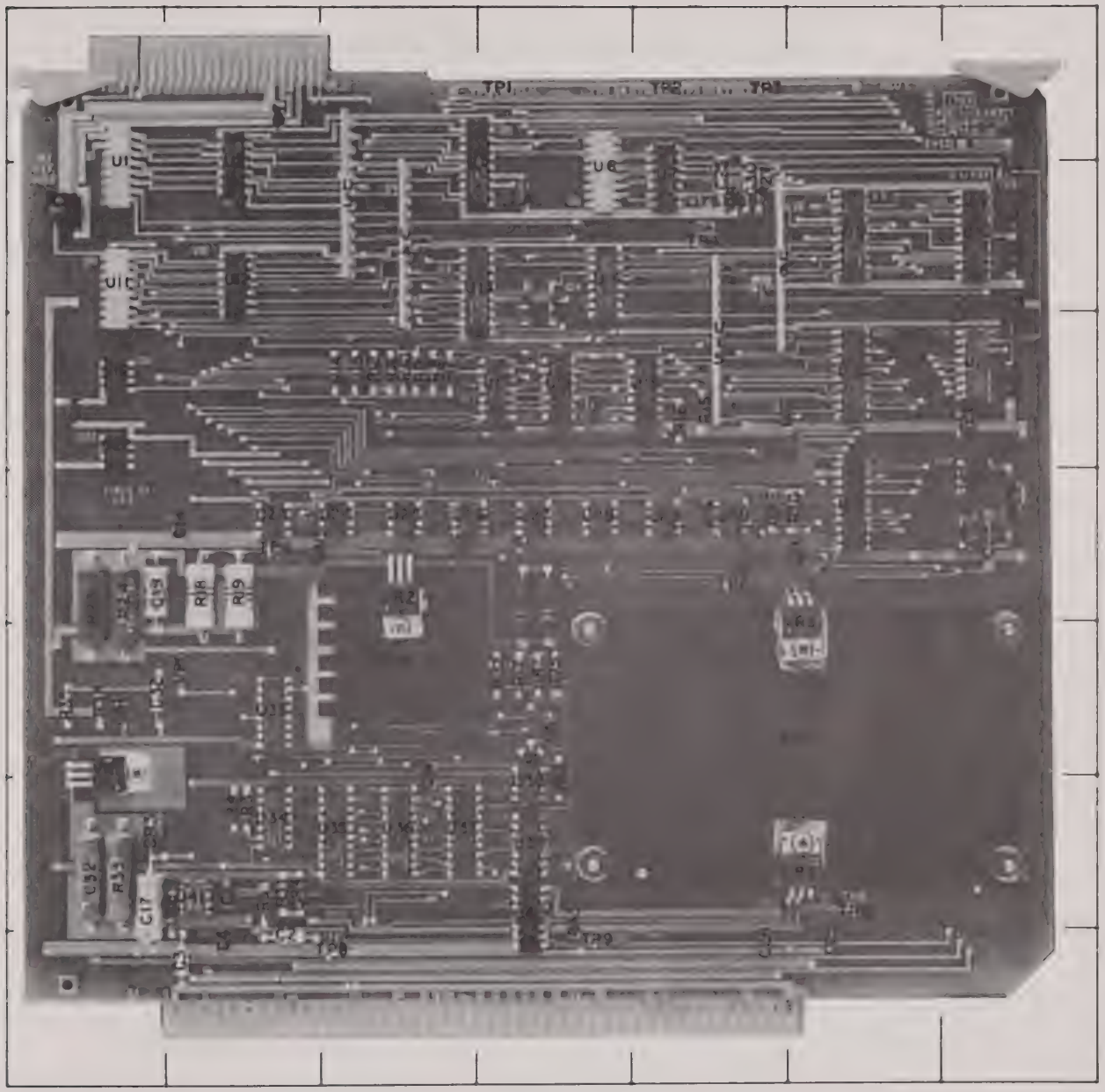

DATA WRITE BUFFERS
ADDRESS LATCHES
BOARD IDENTIFICATION
CPU DATA BUS
TO U9
+5V
U11 51
U1 51
U12
U2
U4 6.8K
U3 6.8K
U16 A,B
U22 A,B
U23
U24
U25
U31 LATCH
U13 LATCH
U5 LATCH
U36 BUFFER
U35 BI-DIR BUFFER
U33
U34 A
U34 B
U34 C
R1 150
R2 150
R3 1K
R4 1K
LADD
LDW
LRST
LIDEN
P1


TO/FROM PROM PROGRAMMER MODULE
DATA WRITE LATCHES
DATA READ BUFFERS
I.D. & CURRENT OVERLOAD BUFFER
FUNCTION SELECTOR
FAIL SAFE TIMER
MOTHER BOARD
P/O U17
R7 180K
R8 180K
R9 180K
R10 180K
R11 180K
R12 180K
R13 180K
R14 180K
R15 1.21K
R16 3.83
U15 6.8K
U18 A
U18 B
U18 C
U18 D
U19 A
U19 B
U19 C
U19 D
U20
U27
U28
U29
U30
U39A
U39B
U39C
U39D
U40A
U40B
U41
TP1
TP2 (S.A. STOP)
TP3 (S.A. START)
TP4
TP8
TP9
(S.A. CLOCK)
LADD
LDAC
LDW
LID
LDR
LTRST
16CNTR
DSCHG
TRIG
THLD
CNTLV
RST
VCC
OUT
GND
C1 .1 UF
C2 1 UF
C3 1UF
C4 .1UF
C17 22 UF
FROM U13
+5V
NC


ADJUSTABLE REGULATORS
CURRENT SOURCE
CURRENT TO VOLTAGE CONVERTER
CURRENT OVERLOAD SENSOR
DIGITAL TO ANALOG CONVERTER
DAC LATCH
ADJUSTABLE REGULATOR
IC POWER SUPPLY CONFIGURATION
TOP VIEW VR1-VR4
IN
OUT
ADJ.
PARTS ON THIS SCHEMATIC
C1-33
CR1-4
Q1
R1-36
TP1-10
U1-41
VR1-6
MODEL 64501A POSITIVE PROM PROGRAMMER



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-2	C18	C-4	CR2	F-4	R12	C-5	R29	G-5	TP10	F-2	U17	D-5	U34	B-2
C2	B-1	C19	B-4	CR3	A-2	R13	C-5	R30	F-4	U1	A-7	U18	D-5	U35	C-2
C3	B-1	C20	C-4	CR4	B-2	R14	C-5	R31	B-2	U2	B-7	U19	E-5	U36	C-2
C4	B-1	C21	G-4	MP1	F-3	R15	E-5	R32	A-2	U3	C-6	U20	F-5	U37	C-2
C5	D-3	C22	G-5	MP2	C-3	R16	E-5	R33	A-2	U4	C-6	U21	G-5	U38	D-2
C6	G-6	C23	G-4	Q1	D-3	R17	D-3	R34	A-3	U5	D-7	U22	A-5	U39	D-2
C7	B-7	C24	G-5	R1	D-6	R18	B-4	R35	A-3	U6	D-6	U23	B-4	U40	D-2
C8	D-6	C25	E-6	R2	D-6	R19	B-4	R36	A-6	U7	E-6	U24	C-4	U41	B-2
C9	E-6	C26	F-4	R3	B-2	R20	D-4	TP1	D-7	U8	F-6	U25	C-4	VR1	A-3
C10	G-5	C27	E-4	R4	B-2	R21	D-4	TP2	E-7	U9	F-6	U26	D-4	VR2	C-4
C11	A-5	C28	E-1	R5	B-2	R22	D-3	TP3	E-7	U10	G-6	U27	D-4	VR3	F-4
C12	D-5	C29	F-1	R6	B-2	R23	A-4	TP4	E-6	U11	A-6	U28	D-4	VR4	F-2
C13	F-5	C30	E-6	R7	C-5	R24	A-4	TP5	G-6	U12	B-6	U29	E-4	VR5	D-2
C14	B-4	C31	A-3	R8	C-5	R25	D-3	TP6	B-4	U13	D-6	U30	E-4	VR6	B-3
C15	E-4	C32	B-3	R9	C-5	R26	G-4	TP7	E-4	U14	D-6	U31	F-4		
C16	C-3	C33	D-2	R10	C-5	R27	E-6	TP8	C-1	U15	E-5	U32	G-4		
C17	A-2	CR1	D-3	R11	C-5	R28	G-6	TP9	D-9	U16	A-5	U33	B-3		

Table 8-1. Prom Programmer Mnemonics (con't).

LSTB	Low Strobe -- when LSTB and LWRT are both low, the CPU is writing to a device over the CPU's Data Bus. If LSEL is also low, the Prom Programmer will recieve the information. If LSEL is high, the Prom Programmer will not pay attention to the information sent on the bus. If LSTB is low, and LWRT is high, and the Prom Programmer is selected (LSEL low), then the Prom Programmer will return information to the CPU over the CPU's Data Bus.
LWRT	Low Write -- when low, indicates the CPU is writing to the addressed device.
VP1-2	Voltage, Programmable 1 and 2 -- Adjustable Regulators used for developing various voltages and waveforms used for programming Proms. The adjustable inputs (VP1R and VP2R) can be connected to LP1 and LP2 or to voltage dividers located on the Programmer Modules.

Table 8-1. Prom Programmer Mnemonics (con't).

LDW	Low Data Write -- when low, allows the CPU's Data Bus information to be latched into the Data Write Latch. The outputs of the Latch become the Data to be written to the Prom being programmed.
LID	Low Identification -- when low, allows the Identification Code from the Programmer Module to be buffered by the I.D. and Current Sense Buffer, and returned to the CPU over the CPU's Data Bus. Current Overload Status is also sent to the CPU at this time.
LIDEN	Low Identification Enable -- when low along with LSEL, and LSTB, LD12 will go low. When LD12 is low and the other Data Lines are high, the CPU will recognize that there is a Positive Prom Programmer installed in the Mainframe's Card Cage.
LP1-2	Low Program 1 and 2 -- these two lines are used in conjunction with VP1 and VP2 to develope the various voltages and waveforms used to program Proms. Sometimes LP1 and/or LP2 are looped back from the Programmer Module to VP1 and/or VP2.
LPOP	Low Power On Pulse -- resets all latches on the Prom Control Board, so that power dissiapation is minimum. LPOP will override the Timer in the event of an A.C. Power transient. When low, causes LRST to go low.
LRST	Low Reset -- when low, LRST will reset both Address Latches, the Data Write Latch, and the DAC Latch. Reseting these Latches causes the Address to be 0000 HEX with 00 HEX being the Data written, and the lowest power dissipation possible in the Prom being programmed.
LSEL	Low Select -- when low, allows the Prom Programmer Select Code to be returned over the CPU's Data Bus. This allows the CPU to identify if there is a Prom Programmer installed in the Mainframe, and if so, which slot of the Card Cage it is installed in. LSEL also enables the Function Selector.

Table 8-1. Prom Programmer Mnemonics.

A0-15	Address 0 through 15 -- these sixteen address lines are sent to the Programmer Module from the Prom Programmer. Some or all of them may be used to program a Prom. they are derived from the data sent to the Prom Programmer over the CPU Data Bus (LD0-15) by the CPU.
DR0-7	Data Read 0 through 7 -- these data lines are used to read the data contents of a programmed Prom. The data read is sent to the CPU over the CPU Data Bus for verification. Some or all of these lines may be used.
DW0-7	Data Write 0 through 7 -- these data lines are used to write data to the Prom being programmed. The data sent to the Prom is derived from the information sent over the CPU Data Bus by the CPU. Some or all of these lines may be used.
ID0-4	Identification 0 through 4 -- these five lines are used to return Identification Codes from the Programmer Modules to the CPU over the CPU Data Bus. By returning an ID Code, the CPU can determine which Programmer Module is installed, and therefore, can tell the operator via the CRT which Proms may be programmed.
LA12-13	Low Address 12 and 13 -- two of sixteen address lines from the Address Bus (P/O CPU Bus) used to select different functions on the Prom Programmer.
LADD	Low Address -- when low, allows the information on the CPU Data Bus to be latched into the Address Latches. From the outputs of these two Latches, the information becomes the address for the Prom being programmed.
LD0-15	Low Data 0 through 15 -- a 16 bit bidirectional bus that is part of the CPU Bus.
LDAC	Low Digital to Analog Converter -- when low, allows the CPU's Data Bus information to be latched into the DAC Latch, setting the voltage at TP6 (VP3).
LDR	Low Data Read -- when low, allows the data read from the programmed Prom to be returned to the CPU for verification.

8-43. Data Write Buffers U23 through U30 are Dual Rositive AND Drivers. Each section of the Drivers can sink about 250 mA. Both sections are connected in parallel to allow sinking of about 500 mA. The Prom data write lines are connected in different ways for each Programmer Module, and is discussed in detail in the Theory of Operation for each Module.

8-44. Prom Data Verificaton.

8-45. After a word is written to the Prom, it is read back to the CPU for verificaton. If it is correct, the CPU moves to the next word to be written. If it is incorrect, the CPU may or may not attempt to write it again, depending on the type of Prom being programmed. If the CPU decides the Prom cannot be programmed, a failure message appears on the screen.

8-46. Verification is done through Data Read Buffers U18 and U19. U18 and U19 provide a high impedance input for the Prom. U18 and U19 are made TTL compatable by R15 and R16, setting the input threshold to +1.2 V. Resistor Package U15 pulls the comparators up for the inputs of the Data Read Buffers U20.

8-47. When requested by the CPU, through Function Selector U14 (LDR), the data will be returned to the CPU for verification via U20 and U35.

8-48. Signals in the PROM Programmer have been assigned Mnemonics that describe the active state and function of the signal line. Mnemonic functional deffinations are listed alphabetically in Table 8-1.

8-33. Current Sensor.

8-34. R19 and R20 are current sensing resistors that develop a voltage proportional to the current being drawn by the Prom. R22 and R23 are load resistors for VR2 when there is no Prom in the Module's socket.

8-35. Current Source Q1 developes 20 mV accross R24 with 1 mA of current. R24's 20 mV in addition to the voltage developed accross R19 and R20, with no load, will keep U38's output in the high state. This indicates to the CPU that less than 400 mA is being drawn from VR2.

8-36. When current through R19 and R20 is greater than 400 mA, the voltage accross R19 and R20 becomes great enough to offset the 20 mV accross R24. When this happens, the output of U38 goes to a low state indicating to the CPU that an overload condition exists. The CPU then reprograms the Power Supply to +1.2 V until the overload is removed.

8-37. Adjustable Voltage Sources.

8-38. VR3 and VR4 are Adjustable Regulators that are referenced by the Programmer Module. The voltages are different for the various Modules and may be found inthe Theory of Operation for the Programmer Modules. The outputs are 1.2 V more positive than the adjustment inputs.

8-39. Positive Prom Programming.

8-40. The sequence of events is different for the various Proms and will not be presented in detail here. For detailed information see the appropriate Manufacturer's Data Sheets for the Prom being programmed.

8-41. U5 and U13 latch the address to the Prom being programmed. The address is clocked into the filp-flops by U14 when directed by the CPU. They will be cleared in the event of any power up sequence by LPOP, or by the Fail-Safe Timer.

8-42. U31 latches the data to be written to the Prom being programmed. The data is clocked into the flip-flops by U14 when directed by the CPU. They will be cleared in the event of any power up sequence by LPOP, or by the Fail-Safe Timer.

8-24. Positive Prom Programmer Identification.

8-25. When the CPU forces LID, LSEL, and LSTB low, and the Positive Prom Programmer is present in the Mainframe, a low state on LD12 is developed by Card I.D. U34. (Pull-up resistors on CPU data bus pull other data lines high.) EFFF HEX is returned to the CPU on the Data Bus. If FFFF HEX is returned, the CPU will not allow positive prom programming.

8-26. Programmer Module Identification.

8-27. Programmer Module Identification Code is developed on the Module's P.C. Board. The I.D. Code is generated by grounding combinations of lines ID0 through ID4, A12, and A13 in the Programmer Module. A12 and A13 are shared between Prom Address and I.D. Code. R1 and R2 allow the Programmer Module to pull A12 and A13 low for the I.D. code without damaging the outputs of Address Latch U13, even if they are high.

8-28. The I.D. Code is buffered by I.D. and Current Overload Buffers U9, and is returned through U35 when requested by the CPU. The CPU uses the I.D. Code to determine which Proms may be programmed in the Module installed in the Mainframe. The unique code for each Module may be found in the Theory of Operation for the Programmer Modules.

8-29. Programmable Positive Power Supply.

8-30. After the Prom is installed, the CPU programms power supply VP3 and checks the power being used by the Prom. The DAC Latch U10 latches digital information from the CPU for the Digital to Analog Converter, U21. DAC U21 is referenced to +5 V supplied by an Adjustable Regulator, VR1. DAC U21 converts the 8 bit digital word to a programmed current level that drives the Voltage to Current Converter U32.

8-31. U32 is a current to voltage converter referenced to +29 V. Depending on the current from the the DAC U21 the output voltage will range from approximately 0 V to +25.5 V. With the 8 bit resolution of U21, the output of U32 will have a resolution of .1 V.

8-32. Adjustable Regulator VR2 is referenced to +40 V allowing the output to "follow" the Voltage to Current Converter U32. VR2's output is always 1.2 V greater than U32's output. Therefore, the output of VR2 will vary from +1.2 V to +26.7 V in .1 V steps (U21's input: 00 HEX=+1.2 V, FF HEX=+26.7 V). R23 and R24 share power disipation with VR2.

8-17. Theory of Operation.

8-18. General.

* The Theory of the Positive Prom Progrmmer is discussed in the order of events as they occur due to Software Control.

* The Positive Prom Programmer communicates with the CPU over the CPU Data Bus. Only two address lines are used, LA12 and LA13.

* The Address Lines for the Prom being programmed are developed on the Positive Prom Programmer P.C. Board.

* U35 buffers the lower eight bits of the CPU Data Bus. Control Lines LWRT, LSEL, and LSTB; from the CPU in conjunction with U33 determine if U35 is in the send or receive mode.

* U36 buffers the upper eight bits of the CPU Data Bus, and is receive only on the Positive Prom Programmer.

* U37 buffers CPU Control Lines LSTB, LWRT, LA12, LA13, LSEL, LPOP and Line Sync.

* Function Selector U14 decodes LA12, LA13, and LWRT to control data flow on the Positive Prom Programmer.

8-19. Detailed Theory.

8-20. Fail Safe Timer.

8-21. U39, 40, and U41 form a "Fail-Safe Timer" that uses the output of U41 as the clock. In the event of a failure the Timer prevents over-heating of the Positive Prom Programmer, Programmer Module, and the Prom in the Module's socket. Normally the Timer is reset by the software at least every 100 mS. If the software becomes lost, or some other failure occurs, the Timer will not be reset, and will count all 32 states (approx 500 mS). This forces U39 Pin 8 low, clearing the Address Latches U5 and U13, DAC Latch U10, and Data Write Latch U31. This action causes the lowest possible power dissipation in the Prom Programmer.

8-22. Pulse Generators.

8-23. U16 and U22 are Dual Positive And Drivers. The two sections of each I.C. are connected in parallel to provide about 500 mA of current sinking ability. The two signals developed by the devices are used in various ways in the Programmer Modules to generate pulses and voltage levels of different values. The different values can be found in the Theory of Operation for each of the Programmer Modules.

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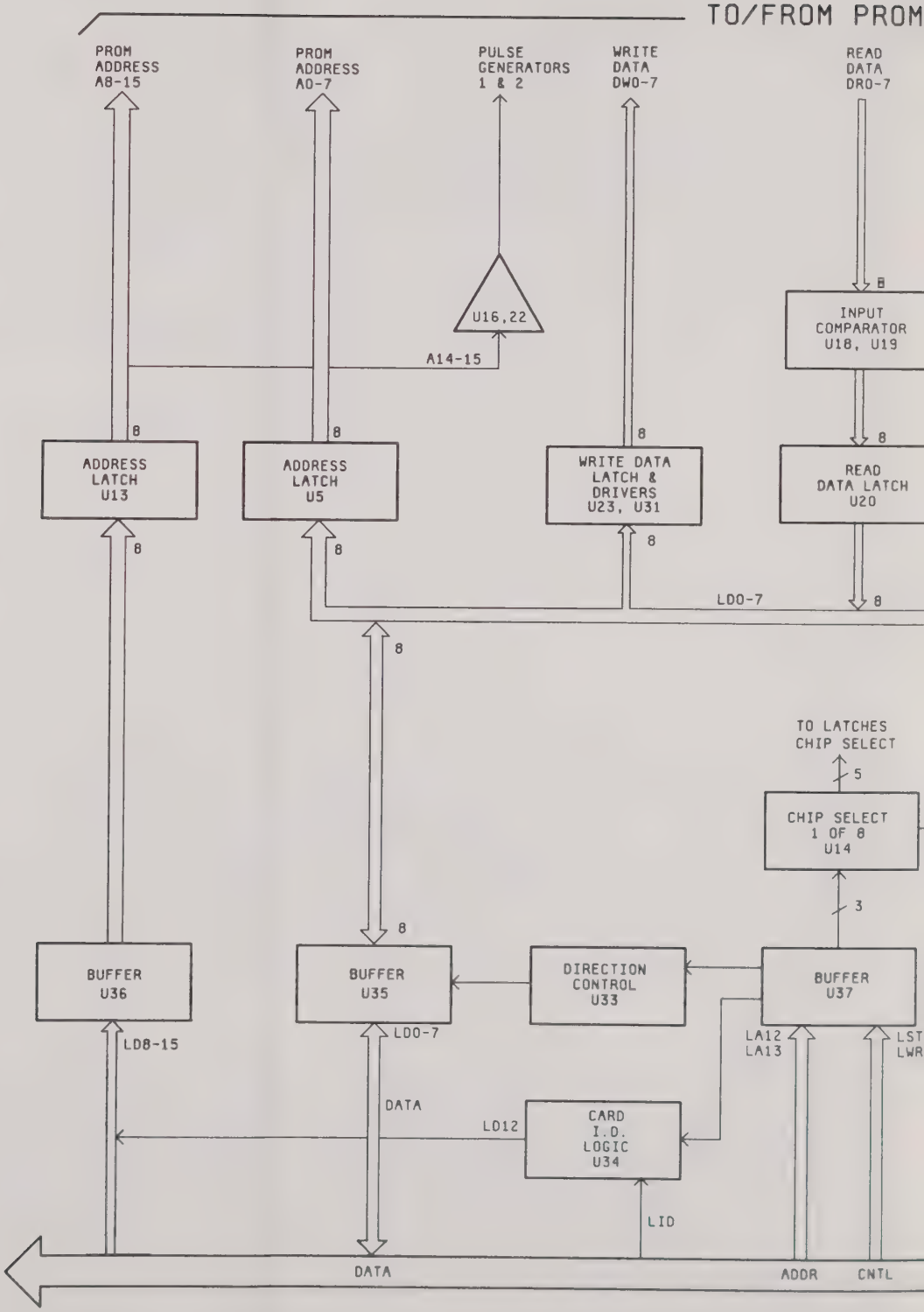
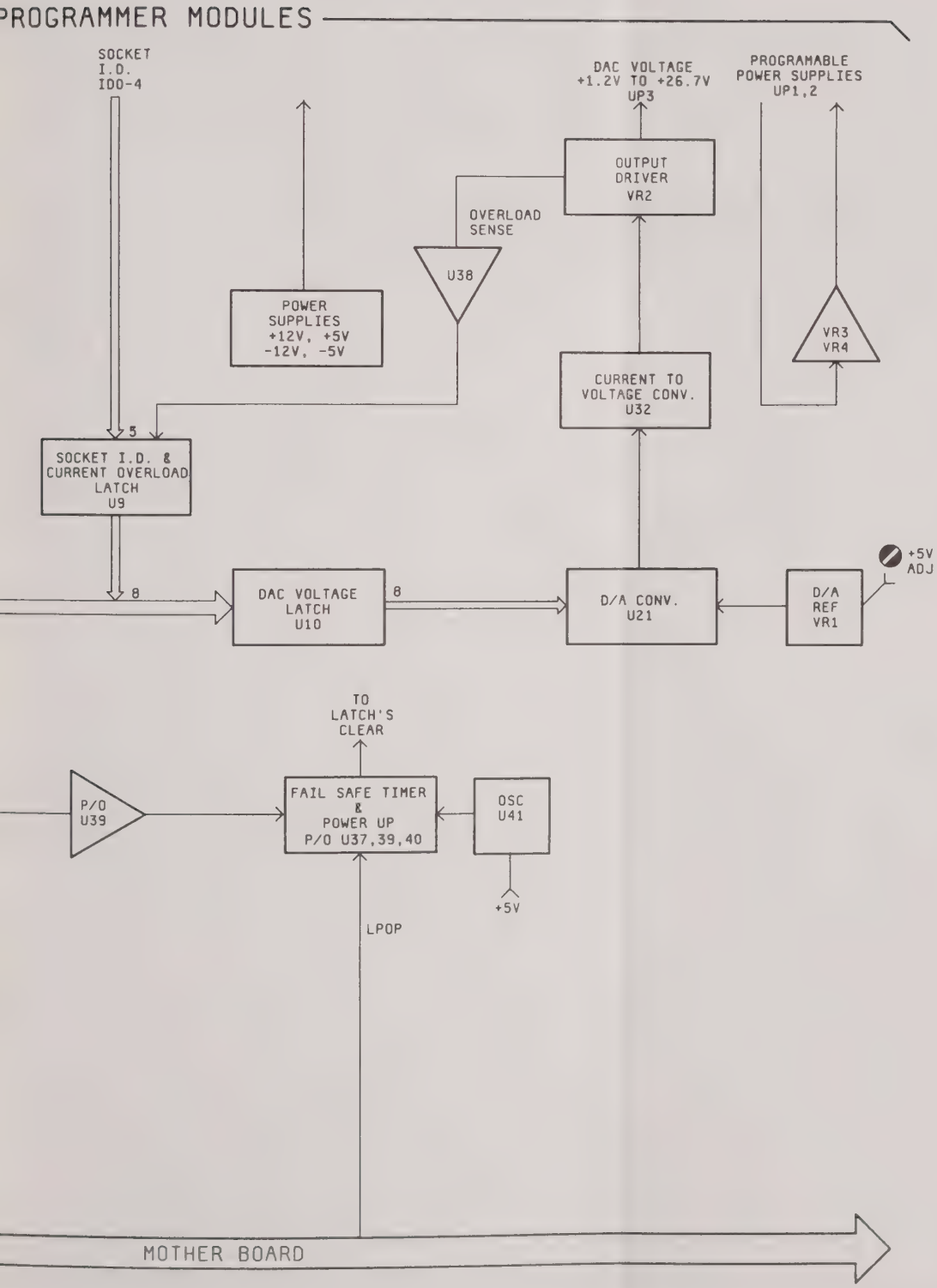

TO/FROM PROM
PROM ADDRESS A8-15
PROM ADDRESS A0-7
PULSE GENERATORS 1 & 2
WRITE DATA DW0-7
READ DATA DR0-7
U16,22
A14-15
INPUT COMPARATOR U18, U19
ADDRESS LATCH U13
ADDRESS LATCH U5
WRITE DATA LATCH & DRIVERS U23, U31
READ DATA LATCH U20
LD0-7
TO LATCHES CHIP SELECT
CHIP SELECT 1 OF 8 U14
BUFFER U36
BUFFER U35
DIRECTION CONTROL U33
BUFFER U37
LD8-15
LD0-7
LA12
LA13
DATA
LD12
CARD I.D. LOGIC U34
LID
DATA
ADDR
CNTL



64501A POSITIVE PROM PROGRAMMER

8-4. Block Diagram Theory.

8-5. Data Buffers U35, U36 and U37 buffer the Positive Prom Programmer from the CPU Bus.

8-6. Function Selector U14 controls the various functions on the Positive Prom Programmer. U33 determines which direction data flows through U35.

8-7. U39, U40, and U41 form a Timer to prevent over heating of the Programmer's components if the CPU should become lost in the software.

8-8. U16 and U22 are used to develop pulses and voltages required to program the Prom.

8-9. Board I.D. U34 developes the Positive Prom Programmer Identification code.

8-10. I.D. and Current Overload Buffer U9 returns the Programmer Module's Identification Code and Current Overload Status to the CPU.

8-11. DAC Latch U10, DAC U21, Current to Voltage Converter U32, and Adjustable Regulators VR1 and VR2, form a programmable voltage source. The range is +1.2 V to +26.7 V in .1 volt steps.

8-12. U38 is a current overload sensor.

8-13. VR3 and VR4 are Adjustable Voltage Regulators.

8-14. Address Latches U5 and U13 develop the Prom's address.

8-15. Data Write Buffers U23 through U31 write the data to the Prom being programmed.

8-16. Data Read Buffers U18, U19, and U20 return the data read from the Prom to the CPU for verificaton.

Section VIII

Theory and Schematics

8-1. Introduction.

8-2. This section contains information for troubleshooting and repairing the Model 64501A PROM Programmer.

8-3. The block diagram, schematic, component location figure, and other service information are provided on fold-out service sheets to help you in servicing the Model 64501A PROM Programmer.

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Section VII

Manual Backdating

This Section normally contains information for backdating this Manual for Models with repair numbers prior to the one shown on the Title Page. Because this Edition includes the information for the first repair number, there is no backdating material.

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Table 6-3. Manufacturers' Codes

Mfr No.	Manufacturer Name	Address		Zip Code
00000	ANY SATISFACTORY SUPPLIER			
00480	NORELCO NORTH AMER PHILIPS LTG CORP	LOS ANGELES	CA	90021
01121	ALLEN-BRADLEY CO	MILWAUKEE	WI	53204
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS	TX	75222
01928	RCA CORP SOLID STATE DIV	SOMERVILLE	NJ	08876
03888	KDI PYROFILM CORP	WHIPPANY	NJ	07981
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX	AZ	85062
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW	CA	94042
09023	CORNELL-DUBILIER ELEK DIV FED PAC	SANFORD	NC	27330
13103	THERMALLOY CO	DALLAS	TX	75234
19701	MEPCO/ELECTRA CORP	MINERAL WELLS	TX	76067
20940	MICRO-OHM CORP	EL MONTE	CA	91731
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD	PA	16701
26654	VARADYNE INC	SANTA MONICA	CA	90404
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA	CA	95051
27777	VARO SEMICONDUCTOR INC	GARLAND	TX	75040
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO	CA	94304
30983	MEPCO/ELECTRA CORP	SAN DIEGO	CA	92121
32997	BOURNS INC TRIMPOT PROD DIV	RIVERSIDE	CA	92507
34334	MOTOROLA INC	FRANKLIN PARK	IL	60131
34649	INTEL CORP	MOUNTAIN VIEW	CA	95051
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS	MA	01247
71590	CENTRALAB ELEK DIV GLOBE-UNION INC	MILWAUKEE	WI	53201
72136	ELECTRO MOTIVE CORP SUB IEC	WILLIMANTIC	CT	06226
75042	TRW INC PHILADELPHIA DIV	PHILADELPHIA	PA	19108
75382	KULKA ELECTRIC CORP	MT VERNON	NY	10550
75915	LITTELFUSE INC	DES PLAINES	IL	60016

See introduction to this section for ordering information

Table 6-2. Replaceable Parts List

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
R21	0811-1800	5		RESISTOR .1 10% 2W PW TC=0+-800	75042	BWH2-2-1/10-K
R22	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
R23	0811-1854	5	2	RESISTOR 50 5% 5W PW TC=0+-20	28480	0811-1854
R24	0811-1854	5		RESISTOR 50 5% 5W PW TC=0+-20	28480	0811-1854
R25	0698-3155	1	1	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
R26	0811-2043	6	1	RESISTOR 12.71K .1% .25W PWW TC=0+-10	20940	143-1/8-E-12711-B
R27	0698-3239	2	1	RESISTOR 1.5K .25% .125W F TC=0+-50	28480	0698-3239
R28	0698-4055	2	1	RESISTOR 1K .25% .125W F TC=0+-100	03888	PME55-1/8-T0-1001-C
R29	0684-1021	1		RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CB1021
R30	0757-0403	2	3	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
R31	0757-0403	2		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
R32	0811-1853	4	2	RESISTOR 25 5% 5W PW TC=0+-20	28480	0811-1853
R33	0811-1853	4		RESISTOR 25 5% 5W PW TC=0+-20	28480	0811-1853
R34	0757-0403	2		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
R35	0698-3445	2	1	RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
R36	2100-2520	9	1	RESISTOR-TRMR 50 20% C SIDE-ADJ 1-TRN	30983	ET50X500
TP1-	0360-0535	0	10	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP10	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
U1	1810-0301	4	3	NETWORK-RES 16-DIP$1.0 OHM X 8	01121	3168$10
U2	1906-0074	1	4	DIODE-ARRAY 50V 400MA	28480	1906-0074
U3	1810-0049	7	4	NETWORK-RES 12-8IP6.8K OHM X 10	28480	1810-0049
U4	1810-0049	7		NETWORK-RES 12-8IP6.8K OHM X 10	28480	1810-0049
U5	1820-1730	6	4	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
U6	1810-0301	4		NETWORK-RES 16-DIP$1.0 OHM X 8	01121	3168$10
U7	1906-0074	1		DIODE-ARRAY 50V 400MA	28480	1906-0074
U8	1810-0049	7		NETWORK-RES 12-8IP6.8K OHM X 10	28480	1810-0049
U9	1820-2024	3	3	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
U10	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
U11	1810-0301	4		NETWORK-RES 16-DIP$1.0 OHM X 8	01121	3168$10
U12	1906-0074	1		DIODE-ARRAY 50V 400MA	28480	1906-0074
U13	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
U14	1820-1240	3	2	IC DCDR TTL S 3-TO-8-LINE 3-INP	01295	SN74S138N
U15	1810-0049	7		NETWORK-RES 12-8IP6.8K OHM X 10	28480	1810-0049
U16	1820-2207	4	2	IC DRVR TTL AND DUAL	01295	SN75471P
U17	1906-0074	1		DIODE-ARRAY 50V 400MA	28480	1906-0074
U18	1826-0130	8	2	IC COMPARATOR GP QUAD 14-DIP-P	04713	MLM339P
U19	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P	04713	MLM339P
U20	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
U21	1826-0188	8	1	IC CONV 8-B-D/A 16-DIP-C	04713	MC1408L-8
U22	1820-2207	4		IC DRVR TTL AND DUAL	01295	SN75471P
U23	1820-2044	7	8	IC DRVR TTL AND DUAL 2-INP	01295	SN75461P
U24	1820-2044	7		IC DRVR TTL AND DUAL 2-INP	01295	SN75461P
U25	1820-2044	7		IC DRVR TTL AND DUAL 2-INP	01295	SN75461P
U26	1820-2044	7		IC DRVR TTL AND DUAL 2-INP	01295	SN75461P
U27	1820-2044	7		IC DRVR TTL AND DUAL 2-INP	01295	SN75461P
U28	1820-2044	7		IC DRVR TTL AND DUAL 2-INP	01295	SN75461P
U29	1820-2044	7		IC DRVR TTL AND DUAL 2-INP	01295	SN75461P
U30	1820-2044	7		IC DRVR TTL AND DUAL 2-INP	01295	SN75461P
U31	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
U32	1826-0207	2	1	IC OP AMP HS 8-DIP-P	27014	LM318N
U33	1820-1240	3		IC DCDR TTL S 3-TO-8-LINE 3-INP	01295	SN74S138N
U34	1820-1568	8	1	IC BFR TTL LS BUS QUAD	01295	SN74LS125AN
U35	1820-2075	4	1	IC MISC TTL LS	01295	SN74LS245N
U36	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
U37	1820-1624	7	1	IC BFR TTL S OCTL 1-INP	01295	SN74S241N
U38	1826-0065	0	1	IC COMPARATOR PRCN 8-DIP-P	01295	SN72311P
U39	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
U40	1820-1989	7	1	IC CNTR TTL LS BIN DUAL 4-BIT	07263	74LS393PC
U41	1826-0180	0	1	IC TIMER TTL MONO/ASTBL	04713	MC1455P1
VR1	1826-0393	7	4	LM317T	27014	LM317T
VR2	1826-0393	7		LM317T	27014	LM317T
VR3	1826-0393	7		LM317T	27014	LM317T
VR4	1826-0393	7		LM317T	27014	LM317T
VR5	1902-0074	3	1	DIODE-ZNR 7.15V 5% DO-7 PD=.4W TC=+.047%	28480	1902-0074
VR6	1902-3172	8	1	DIODE-ZNR 11V 2% DO-7 PD=.4W TC=+.062%	28480	1902-3172
W1	64501-61601	1	1	CABLE, POSITIVE PROM	28480	64501-61601
				MISCELLANEOUS PARTS		
	7120-6492	9	1	LABEL, WARNING	28480	7120-6492
	1200-0796	8	1	SOCKET-IC 8-CONT DIP DIP-SLDR	28480	1200-0796

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts List

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	64501-66501	0	1	BOARD ASSEMBLY, PROM PROGRAM	28480	64501-66501
C1	0160-3622	8	23	CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C2	0180-0230	0	6	CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
C3	0180-0230	0		CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
C4	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C5	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C6	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C7	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C8	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C9	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C10	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C11	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C12	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C13	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C14	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C15	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C16	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C17	0180-1794	3	1	CAPACITOR-FXD 22UF+-10% 35VDC TA	56289	150D226X9035R2
C18	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C19	0180-0269	5	1	CAPACITOR-FXD 1UF+50-10% 150VDC AL	56289	30D105G150BA2
C20	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C21	0160-2207	3	1	CAPACITOR-FXD 300PF +-5% 300VDC MICA	28480	0160-2207
C22	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C23	0180-0230	0		CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
C24	0140-0203	3	1	CAPACITOR-FXD 30PF +-5% 500VDC MICA	72136	DM15E300J050WV1CR
C25	0180-0230	0		CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
C26	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C27	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C28	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C29	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C30	0180-0230	0		CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
C31	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C32	0180-0230	0		CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
C33	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
H1	2360-0117	6	4	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
H2	2200-0105	4	3	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
H3	2200-0107	6	1	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
H4	3050-0066	8	4	WASHER-FL MTLC NO. 6 .147-IN-ID	28480	3050-0066
H5	3050-0235	3	2	WASHER-FL MTLC NO. 4 .117-IN-ID	28480	3050-0235
H6	2190-0005	0	2	WASHER-LK EXT T NO. 4 .116-IN-ID	28480	2190-0005
H7	2260-0001	9	2	NUT-HEX-DBL-CHAM 4-40-THD .094-IN-THK	28480	2260-0001
H8	2420-0001	5	4	NUT-HEX-W/LKWR 6-32-THD .109-IN-THK	00000	ORDER BY DESCRIPTION
MP1	1205-0380	6	1	HEAT SINK SPCL-HOLE-PATT	28480	1205-0380
MP2	1205-0376	0	1	HEAT SINK SGL PLSTC-PWR-CS	13103	60728
MP3	0340-0511	0	2	INSULATOR-XSTR KAPTON	28480	0340-0511
MP4	0340-0676	8	2	INSULATOR-FLG-SSMG NYLON	28480	0340-0676
MP5	1480-0116	8	2	PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
MP6	0403-0300	4	1	EXTRACTOR, LEFT	28480	0403-0300
MP7	0403-0349	6	1	EXTRACTOR, RIGHT	28480	0403-0349
Q1	1854-0642	5	1	TRANSISTOR NPN SI PD=625MW FT=80MHZ	04713	MPS-A17
R1	0684-1511	8	2	RESISTOR 150 10% .25W FC TC=-400/+800	01121	CB1511
R2	0684-1511	0		RESISTOR 150 10% .25W FC TC=-400/+800	01121	CB1511
R3	0684-1021	7	3	RESISTOR 1K 10% .25W FC TC=-400/+800	01121	CB1021
R4	0684-1021	7		RESISTOR 1K 10% .25W FC TC=-400/+800	01121	CB1021
R5	0683-5125	8	1	RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
R6	0683-1135	2	1	RESISTOR 11K 5% .25W FC TC=-400/+800	01121	CB1135
R7	0683-1845	1	8	RESISTOR 180K 5% .25W FC TC=-800/+900	01121	CB1845
R8	0683-1845	1		RESISTOR 180K 5% .25W FC TC=-800/+900	01121	CB1845
R9	0683-1845	1		RESISTOR 180K 5% .25W FC TC=-800/+900	01121	CB1845
R10	0683-1845	1		RESISTOR 180K 5% .25W FC TC=-800/+900	01121	CB1845
R11	0683-1845	1		RESISTOR 180K 5% .25W FC TC=-800/+900	01121	CB1845
R12	0683-1845	1		RESISTOR 180K 5% .25W FC TC=-800/+900	01121	CB1845
R13	0683-1845	1		RESISTOR 180K 5% .25W FC TC=-800/+900	01121	CB1845
R14	0683-1845	1		RESISTOR 180K 5% .25W FC TC=-800/+900	01121	CB1845
R15	0757-0274	5	1	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
R16	0698-3153	9	1	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
R17	0698-3429	2	1	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
R18	0698-3634	1	2	RESISTOR 470 5% 2W MO TC=0+-200	28480	0698-3634
R19	0698-3634	1		RESISTOR 470 5% 2W MO TC=0+-200	28480	0698-3634
R20	0811-1200	5	2	RESISTOR .1 10% 2W PW TC=0+-800	75042	BWH2-2-1/10-K

See introduction to this section for ordering information
*Indicates factory selected value

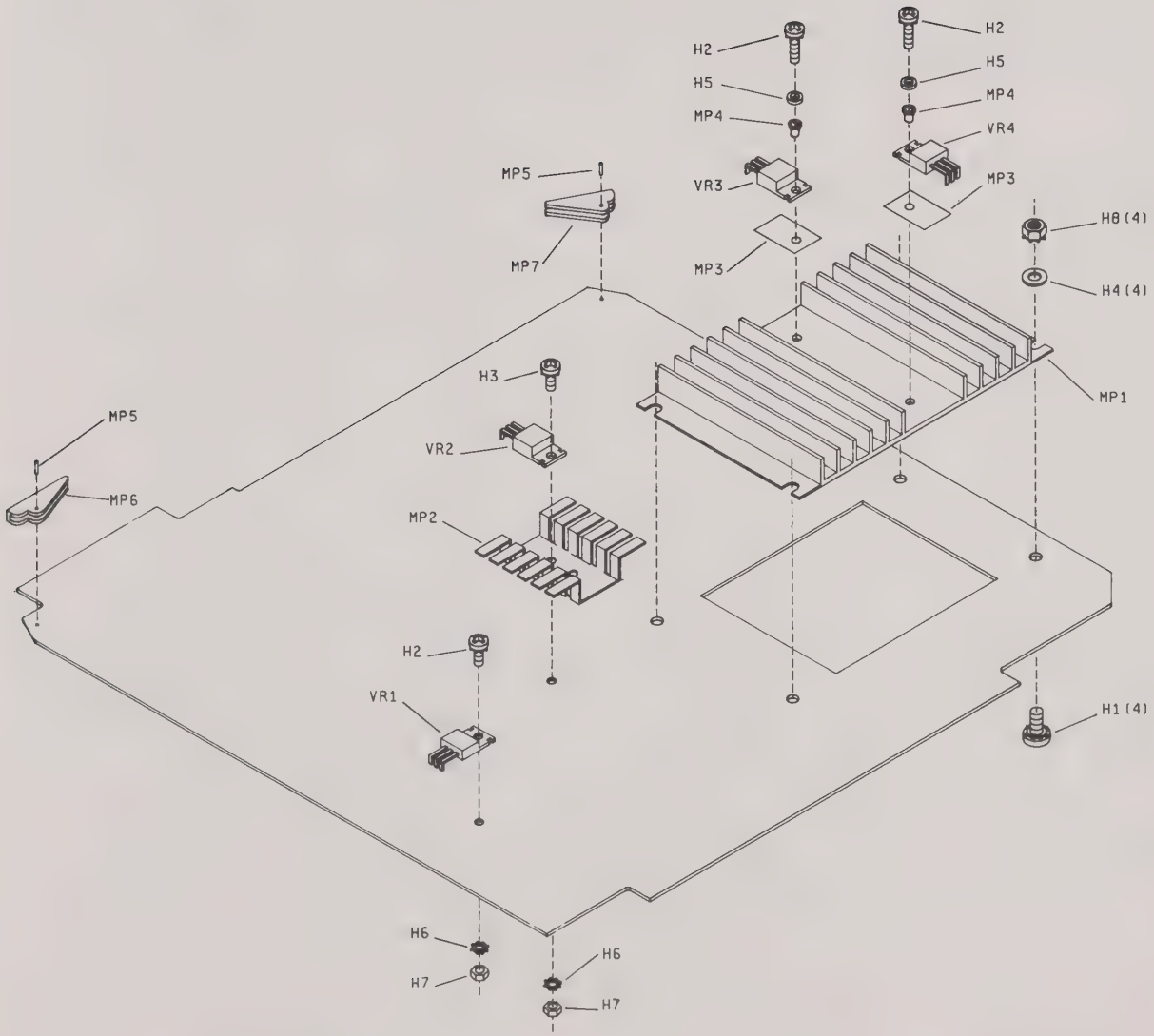

Figure 6-1. Illustrated Parts Breakdown

Table 6-1. Reference Designators and Abbreviations

REFERENCE DESIGNATORS

A	= assembly	F	= fuse	MP	= mechanical part	U	= integrated circuit
B	= motor	FL	= filter	P	= plug	V	= vacuum, tube, neon bulb, photocell, etc
BT	= battery	IC	= integrated circuit	Q	= transistor		
C	= capacitor	J	= jack	R	= resistor	VR	= voltage regulator
CP	= coupler	K	= relay	RT	= thermistor	W	= cable
CR	= diode	L	= inductor	S	= switch	X	= socket
DL	= delay line	LS	= loud speaker	T	= transformer	Y	= crystal
DS	= device signaling (lamp)	M	= meter	TB	= terminal board	Z	= tuned cavity network
E	= misc electronic part	MK	= microphone	TP	= test point		

ABBREVIATIONS

A	= amperes	H	= henries	N/O	= normally open	RMO	= rack mount only
AFC	= automatic frequency control	HDW	= hardware	NOM	= nominal	RMS	= root-mean square
AMPL	= amplifier	HEX	= hexagonal	NPO	= negative positive zero (zero temperature coefficient)	RWV	= reverse working voltage
		HG	= mercury				
BFO	= beat frequency oscillator	HR	= hour(s)				
BE CU	= beryllium copper	HZ	= hertz	NPN	= negative-positive-negative	S-B	= slow-blow
BH	= binder head					SCR	= screw
BP	= bandpass			NRFR	= not recommended for field replacement	SE	= selenium
BRS	= brass	IF	= intermediate freq			SECT	= section(s)
BWO	= backward wave oscillator	IMPG	= impregnated	NSR	= not separtely replaceable	SEMICON	= semiconductor
		INCD	= incandescent			SI	= silicon
CCW	= counter-clockwise	INCL	= include(s)			SIL	= silver
CER	= ceramic	INS	= insulation(ed)	OBD	= order by description	SL	= slide
CMO	= cabinet mount only	INT	= internal	OH	= oval head	SPG	= spring
COEF	= coeficient			OX	= oxide	SPL	= special
COM	= common	K	= kilo=1000			SST	= stainless steel
COMP	= composition					SR	= split ring
COMPL	= complete	LH	= left hand	P	= peak	STL	= steel
CONN	= connector	LIN	= linear taper	PC	= printed circuit		
CP	= cadmium plate	LK WASH	= lock washer	PF	= picofarads= 10^{-12} farads	TA	= tantalum
CRT	= cathode-ray tube	LOG	= logarithmic taper			TD	= time delay
CW	= clockwise	LPF	= low pass filter	PH BRZ	= phosphor bronze	TGL	= toggle
				PHL	= phillips	THD	= thread
DEPC	= deposited carbon	M	= milli=10^{-3}	PIV	= peak inverse voltage	TI	= titanium
DR	= drive	MEG	= meg=10^{6}	PNP	= positive-negative-positive	TOL	= tolerance
		MET FLM	= metal film			TRIM	= trimmer
ELECT	= electrolytic	MET OX	= metallic oxide	P/O	= part of	TWT	= traveling wae tube
ENCAP	= encapsulated	MFR	= manufacturer	POLY	= polystyrene		
EXT	= external	MHZ	= mega hertz	PORC	= porcelain	U	= micro=10^{-6}
		MINAT	= miniature	POS	= position(s)		
F	= farads	MOM	= momentary	POT	= potentiometer	VAR	= variable
FH	= flat head	MOS	= metal oxide substrate	PP	= peak-to-peak	VDCW	= dc working volts
FIL H	= fillister head	MTG	= mounting	PT	= point		
FXD	= fixed	MY	= "mylar"	PWV	= peak working voltage	W/	= with
						W	= watts
G	= giga (10^{9})	N	= nano (10^{-9})	RECT	= rectifier	WIV	= working inverse voltage
GE	= germanium	N/C	= normally closed	RF	= radio frequency		
GL	= glass	NE	= neon	RH	= round head or right hand	WW	= wirewound
GRD	= ground(ed)	NI PL	= nickel plate			W/O	= without

6-7. Ordering Information.

6-8. To order a part listed in the replaceable parts table, quote the Hewlwtt-Packard part number and check digit, indicate the quantity required, and address the order to the nearest HewlettPackard office.

6-9. To order a part that is not listed in the replaceable parts table, include the instrument model number, instrument repair number, the description and function of the part, and the number of parts required. Address the order to the nearest HewlettPackard office.

6-10. Direct Mail Order System.

6-11. Within the USA, Hewlett-Packard can supply parts through a direct mail order system. Advantages of using the system are as follows:

a. Direct ordering and shipment from the HP Parts Center in Mountain View, California.

b. No Maximum or minimum on any mail order (there is a minimum order amount, for parts ordered through a local HP office when the orders require billing and invoicing).

c. Prepaid transportation (there is a small handling charge for each order).

d. No invoices - to provide these advantages, a check or money order must accompany each order.

6-12. Mail-order forms and specific ordering information are available through your local HP office. Addresses and phone numbers are located at the back of this manual.

Section VI

Replaceable Parts

6-1. Introduction.

6-2. This section contains information for ordering parts. Table 6-1 lists abbreviations used in the parts list and throughout the manual. Table 6-2 lists all replaceable parts in reference designator order. Table 6-3 contains the names and addresses that correspond to the manufacturers' five-digit code numbers.

6-3. Abbreviations.

6-4. Table 6-1 lists abbreviations used in the parts list, the schematics and throughout the manual. In some cases, two forms of the abbreviation are used: one all in capital letters, and one partial or no capitals. This occurs because the abbreviations in the parts list are always capitals. However, in the schematics and other parts of the manual, other abbreviation forms are used with both lowercase and uppercase letters.

6-5. Replaceable Parts List.

6-6. Table 6-2 is the list of replaceable parts and is organized as follows:

a. Chassis-mounted parts in alphanumerical order by referance designation.

b. Electrical assemblies and their components in alphanumerical order by referance designation.

c. Miscellaneous parts.

The information given for each part consists of the following:

a. The Hewlett-Packard part number and the check digit.

b. The total quantity (Qty) in the instrument.

c. The description of the part.

d. A five-digit code that indicates the manufacturer.

e. The manufacturer's part number.

The total quantity for each part is given only once - at the first appearance of the part number in the list.

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Section V

Adjustment Procedure

5-1. Introduction.

5-2. This section describes adjustments and checks required to return the instrument to peak operating capability after repairs have been made.

5-3. Safety Requirements.

5-4. Although this instrument has been designed in accordance with international safety standards, general safety precautions must be observed during all phases of operation, service, and repair of the instrument. Failure to comply with precautions listed in the Safety Summery at the front of this manual or with specific warnings given throughout the manual could result in serious injury or death. Service adjustments should be performed only by qualified service personnel.

5-5. Equipment Required.

5-6. A Voltmeter capable of .01 Volts D.C. resolution is required for the Adjustment Proceedure.

5-7. Adjustments.

5-8. There is only one Adjustment on the Positive Prom Programmer Board.

5-9. +5 Volt Adjustment.

Press the soft key labeled DAC=10V, and adjust +5V REF, R36, for +9.97V to +10.03V at the DAC output, TP6. Then check the voltage at TP5 for +4.65V to +5.3V.

4-25. Digital to Analog Converter.

4-26. Test 28 (HEX) does not check anything. It is a delay preceding the Digital to Analog Converter tests.

4-27. Tests 29 (HEX) through 2D (HEX) check the Digital to Analog Converter (DAC).

4-28. Test 29 (HEX) sets the DAC to its lowest voltage.

4-29. Test 2A (HEX) checks the Current Sensor at the DAC's lowest voltage with a 50 ohm load.

4-30. Test 2B (HEX) checks the Current Sensor at the DAC's highest voltage, with a 50 ohm load. This insures the current sensing circuits will detect the current overload, and return the detection to the CPU.

4-31. Test 2C (HEX) sets the DAC's output to +14V. This is sent to the Programmer Module, is reduced through a voltage divider, sent to the Priority Encoders, and returned to the CPU via the I.D. Codes and the data bus.

4-32. Test 2D (HEX) repeates Test 2C (HEX) except the voltage is decreased by .1V.

Test# (HEX)	Data Sent	Data Returned	DAC Voltage
29	00	D5	+1.2
2A	00	00	+1.2
2B	FF	*0	+26.7
2C	80	E3	+14.0
2D	7F	E3	+13.9

* 8 HEX is returned with a 50 ohm load.
0 HEX is returned without a 50 ohm load.

4-23. Prom Data.

4-24. Tests 18 (HEX) through 27 (HEX) latches data from the CPU to Write Data for the Prom. It is looped back through the Module to the Prom Programmer and sent back to the CPU as Read Data, verifying continuity from the CPU to the Prom Socket. The data returned to the CPU for verification is identical to that presented by the CPU for the test.

Test# (HEX)	Data
18	01
19	FE
1A	02
1B	FD
1C	04
1D	FB
1E	08
1F	F7
20	10
21	EF
22	20
23	DF
24	40
25	BF
26	80
27	7F

4-17. Troubleshooting Using Performance Verification.

4-18. Prom Address.

4-19. The Positive Prom Programmer and the Self Test Programmer Module (Model 64502A) will be discussed as being one unit. They will not work independently.

4-20. The signal names refere to the inputs/outputs between the Prom Programmer and the Programmer Module, not the interface to the Mother Board, e.g., CPU Data becomes PROM Address.

4-21. Tests 0 (HEX) through 17 (HEX) convert the data from the CPU to the addresse for the Programmer Module. The Programmer Module converts the addresses to I.D. Codes which are returned to the Prom Programmer.

4-22. The Prom Programmer converts the I.D. Codes to data for the CPU, thus verifiying the continuity of the Prom Address Lines.

Test# (HEX)	Address (data from the CPU)	I.D. Codes (data returned to the CPU)
0	FFFF	*1
2	FFFF	*1
3	EFFF	DF
4	DFFF	BF
5	FFFF	F1
6	BFFF	F0
7	FFFF	F1
8	FFFF	F1
9	7FFF	E5
0A	7FFF	E5
0B	7FFE	FF
0C	7FFD	FD
0D	7FFB	FB
0E	7FF7	F9
0F	7FEF	F7
10	7FDF	F5
11	7FBF	F3
12	7F7F	F1
13	7EFF	EF
14	7DFF	ED
15	7BFF	EB
16	77FF	E9
17	3FFF	E6

* Data returned to CPU consists of ID 0-4,A12,A13, and Current Sense. A12 and A13 are not used on the 64502A Module, and "loop" on the Prom Programmer. A12 and A13 are checked in steps 3 and 4.

4-9. Performance Verification Theory.

4-10. The Positive Prom Programmer Operation and Performance Verification includes about 50 individual tests of the digital circuits, and is initiated by pressing the START soft key. The tests are ordered in a manner that checks increasingly complex circuits. The tests also check the ability of the Digital to Analog Converter (DAC) to output its voltage range.

4-11. If all the tests pass, the DAC will generate a staircase ramp each time through the test sequence. Linearity of the ramp should be checked at TP6 with an oscilloscope.

4-12. If a failure is detected in the digital tests, the test sequence stops and an error message appears on screen. The message shows the expected inputs and outputs for the test failed.

4-13. Although all the bits are shown, with the most significant bit on the left, only those bits designated by a "L" or "H" are being checked in that test. Investigating the bits noted by an L or H will qucikly locate the fault. When the status of all bits is not indicated, it implies that the unlisted bits are the complement of the listed bits.

4-14. Pressing START again will cause the test sequence to continue. The counter recording the number of tests failed will increment only once at the end of the sequence if a failure has been detected.

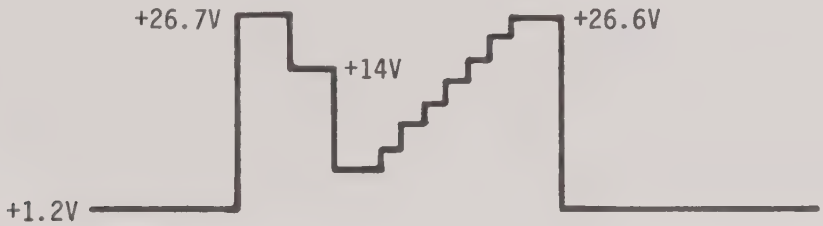
4-15. The CYCLE key allows the test sequence to run continuously without stopping when errors are detected. The number of tests and failures are counted by the counter recording that information. The error messages will write over any error messages existing from previous tests.

4-16. The S/A key allows for the possible use of Signature Analysis to troubleshoot the Prom Programmer if it proves to be necessary.

4-8. Running The Performance Verification.

a. Repeate the Operation Verification (4-7 steps a,b, and c).

b. Connect an oscilloscope to TP6 on the Prom Programmer Board and note the following wave from:



The Waveform should be linear and the steps of equal size.

c. Monitor TP7 on the Prom Programmer Board with an oscilloscope and note it is changing states(TTL levels).

d. Monmentarily touch a 50 ohm 5 watt wire wound resistor between pin 12 (ground) and pin 21 (DAC output) of the Zif Connector on the Programmer Module while in the start cycle, and note the test "DAC=26.7V" fails. This checks the DAC'S overload circuits.

CAUTION
The resistor will get hot!
The DAC is capable of approx. 15 watts.

e. Press DAC=10V and measure +9.9V to +10.1V at TP6 on the Prom Programmer Board. See Section V if not within this range.

f. Press END TEST. Connect an oscilloscope to TP9 on the Programmer Board, and observe that it is changing states.

g. Connect the Reset Test Cable (from the Product Support Package Model 64932A) to Connector J4 on the Input/Output Board. Press the botton on the cable and monitor U39 pin8 on the Prom Programmer Board. The signal should switch from a high state to a low state (TTL Levels) each time the button is pressed.

Section IV

Performance Verification and Troubleshooting

4-1. Introduction.

4-2. This section provides two types of performance tests: Operation Verification and Performance Verification. The Operation Verification provides approximately 90% assurance that the PROM Programmer and the 64502A Programmer Module is capable of programming a pragrammable ROM. The Performance Verification checks the electrical parameters of the PROM Programmer and the 64502A Programmer Module. Unless the detailed Performence Verification is required, we recommend that only the Operation Verification be performed.

4-3. Equipment Required.

4-4. No test equipment is required to perform the Operation Verification. However, the Performance Verification does require an Oscilloscope.

4-5. The HP Model 64502A Programmer Module must be installed when running the Positive Prom Programmer Operation or Performance Verification. See the 64502A Service Manual for the installation procedure.

4-6. If a problem does occur, refer to the Performance Verification Theory for an understanding of its operation. This will help you in troubleshooting the Prom Programmer and the 64502A Programmer Module.

4-7. Running The Operation Verification.

a. Boot up the Operating System from the Disc.(See Operator's Manuals for details.)

b. From the Keyboard call up the Prom P.V. This is done by typing test_option (must be typed in lower case as shown) and pressing the return key. When this is done, a table will be displayed indicating the location of the P.C. Boards in the card cage of the Mainframe. Then the system will ask you to indicate the card slot to be tested. When this is done and the RETURN key is pressed, the Prom P.V. will be initated.

c. Press the START soft key as identified by the Prom P.V., and note the response "Digital Tests Passed".

NOTE
These three tests are normally all that needs to be checked for a 90% confidance level. The following tests are normally performed by Service Personal.

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Section III

Operation

3-1. The operation of the Prom Programmer is a function of the system software. Complete operation from the keyboard of the system is beyond the scope of the Service Manual. Please refer to the Operator's Manuals for the procedure.

2-7. Prom Programmer Cable.

2-8. A 50 conductor ribbon cable, W1, connectes the Prom Programmer to the Programmer Module. The end of the cable with the single connector is connected to the top left corner of the Prom Programmer with the cable towards the front of the Mainframe. The Cable should be routed across the top of the Card Cage and down behind the Front Panel. The two connectors should be visible in the opening for the Programmer Module. Depending on the Module being used, it can have one or two P.C. Boards. If it has only one Board, use the connector nearest the end of the Cable. The P.C. Boards and Cable Connectors are keyed and fit only one way.

Section II

Installation and Removal

2-1. Introduction.

2-2. This section contains information for installing and removing the Model 64502A. Included are initial inspection procedures and instruction for repacking the instrument for shipment.

2-3. Initial Inspection.

2-4. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically Procedures for checking electrical performance are given in Section IV. If the contents are complete, if there is mechanical damage or defect, or if the instrument does not pass the Performance Tests, notify the nearest Hewlett-Packard Office. If the shipping container is damaged, or if the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard Office. Keep the shipping materials for carrier's inspection. The HP office will arrange for repair or replacement at HP option without waiting for claim settlement.

2-5. Installation Proceedure.

2-6. If the Positive Prom Programmer is installed in the Mainframe, it should be positioned in the front most unused connector. This is typically the fourth or fifth connector from the front of the Mainframe. The Input/Output Controller, Display Controller, and the CPU Boards occupy the first three connectors respectively. If it is installed, the Tape Cartridge Controller Board occupies the fourth connector.

NOTE
The Model 64501A Positive Prom Programmer and Programmer Modules must be installed and removed with the Mainframe power turned off!

1-9. Description.

1-10. The Hewlett Packard Model 64500A Positive Prom Programmer is designed to program a wide variety of positive Proms and EProms.

1-11. The Model 64500A consists of one Model 64501A Positive Prom Programmer and one or more Programmer Modules. One Model 64502A Programmer Module is supplied with every 64500A. Other Programmer Modules must be ordered seperately by model number, or by option as part of the Model 64500A.

1-12. Througout this manual the Positive Prom Programmer will be refered to as Model 64501A. It is the same as the Model 64500A except that the 64500A will have options indcuded. The options are the Programmer Modules, i.e., Model 64502A, 64503A, 64504A, etc. The Model 64500A exists for Marketing and ordering purposes. The service information for the Programer Modules is covered in the Service Manual for that Module.

1-13. The Prom Programmer Board may be ordered as Model 64501A. If the board is being ordered for replacement purposes, use the ten digit part number from the material list.

1-14. The Model 64502A is used for Positive Prom Programmer Performance Verification tests, and programming Intel's 2716, Texas Instrument's TMS2516, and TMS2532 programable ROMs.

1-15. Pulse widths and sequences are determined by software.

1-16. Voltage levels, current levels, and rise or fall times are determined by the specific Programmer Hardware Modules.

1-17. The Model 64500A performs the functions of read, write, and verification of programmable memories.

Section I

General Information

1-1. Introduction.

1-2. This Service Manual contains information required to install, test and service the Hewlett-Packard Model 64500A Prom Programmer. Operating instructions are provided in a seperate Operating Manual supplied with the instrument. It should be kept with the instrument for use by the operator.

1-3. Shown on the title page is a microfiche part number. This number can be used to order 4X6-inch microfilm transparencies of the manual. Each microfich contains up to 96 photoduplicates of the manual pages. The microfiche package also includes the latest Manual changes supplement.

1-4. Instruments covered by this manual.

1-5. Attached to the instrument or printed on the printed circuit board is the repair number. The repair number is in the form: 0000A0000. It is in two parts; the first four digits and the letter are the repair prefix, and the last five are the suffix. The prefix is the same for all identical instruments. The suffix, however, is assigned sequentially and is different for each instrument. The contents of this manual apply to instruments with the repair number prefix(es) listed under REPAIR NUMBERS on the title page.

1-6. An instrument manufactured after the printing of this manual may have a repair number prefix that is not listed on the title page. This unlisted repair number prefix indicates that the instrument is different from those described in this manual. The manual for this newer instrument is accomplished by a Manual Changes supplement. This supplement contains "change information" that explains how to adapt the manual for the newer instrument.

1-7. In addition to change information, the supplement contains information for correcting errors in the manual. To keep this manual as current as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is identified with the manual print date and part number, both of which appear on the manual title page. Complimentary copies of the supplement are available from Hewlett-Packard.

1-8. For information concerning a repair number prefix that is not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard Office.

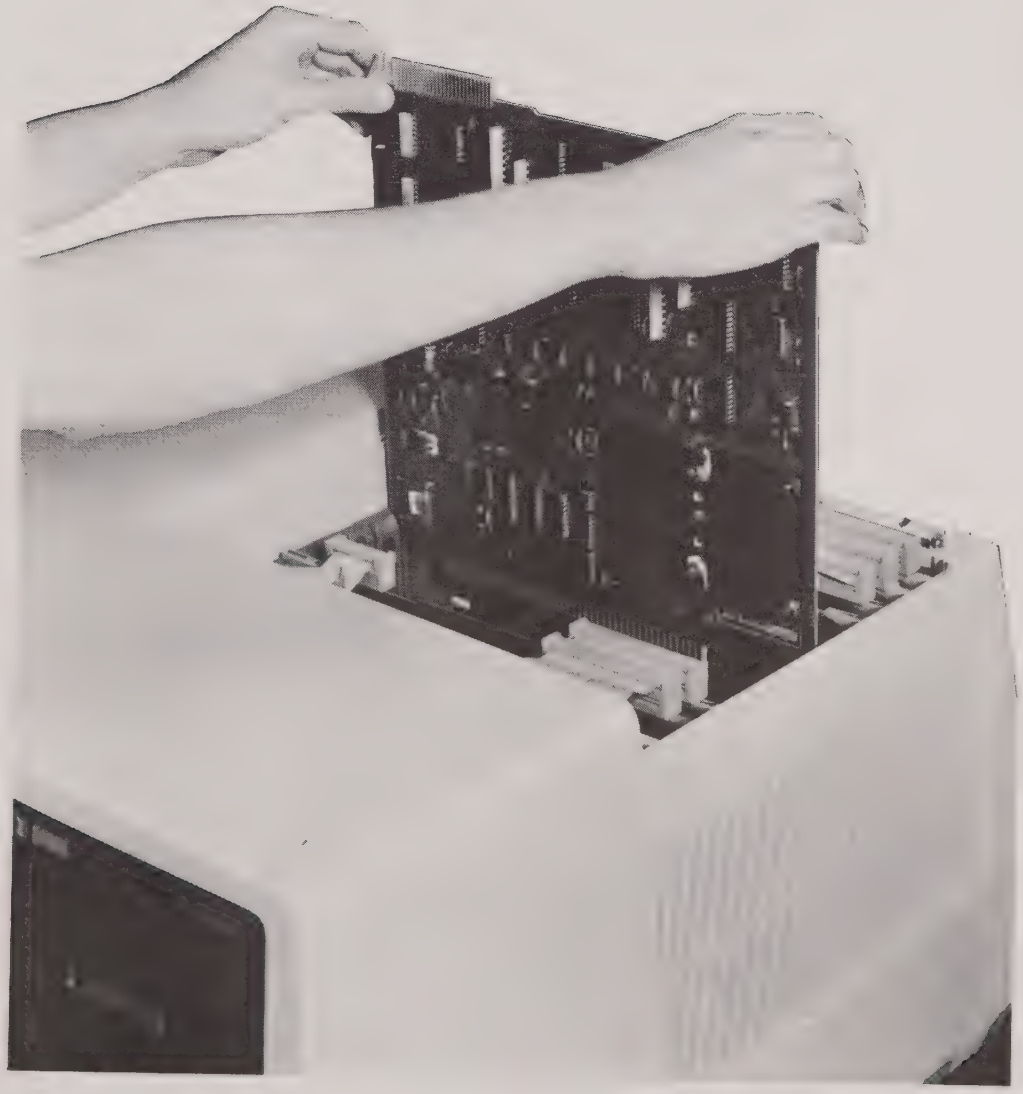

Figure 1-1. Model 64500A PROM Programmer

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SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements.

GROUND THE INSTRUMENT.

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three-conductor ac power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE.

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

KEEP AWAY FROM LIVE CIRCUITS.

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

DO NOT SERVICE OR ADJUST ALONE.

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT.

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification of the instrument. Return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure that safety features are maintained.

DANGEROUS PROCEDURE WARNINGS.

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

WARNING

Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting.

Hewlett-Packard

Service Manual

Model 64500A

Positive Prom Programmer

REPAIR NUMBERS

This Manual applies directly to Models with Repair Numbers prefixed 1924A.

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CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

This Hewlett-Packard system product is warranted against defects in materials and workmanship for a period of 90 days from date of installation. During the warranty period, HP will, at its options, either repair or replace products which prove to be defective.

Warranty service of this product will be performed at Buyer's facility at no charge within HP service travel areas. Outside HP service travel areas, warranty service will be performed at Buyer's facility only upon HP's prior agreement and Buyer shall pay HP's round trip travel expenses. In all other cases, products must be returned to a service facility designated by HP.

For products returned to HP for warranty service. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGEL THEORY.

ASSISTANCE

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

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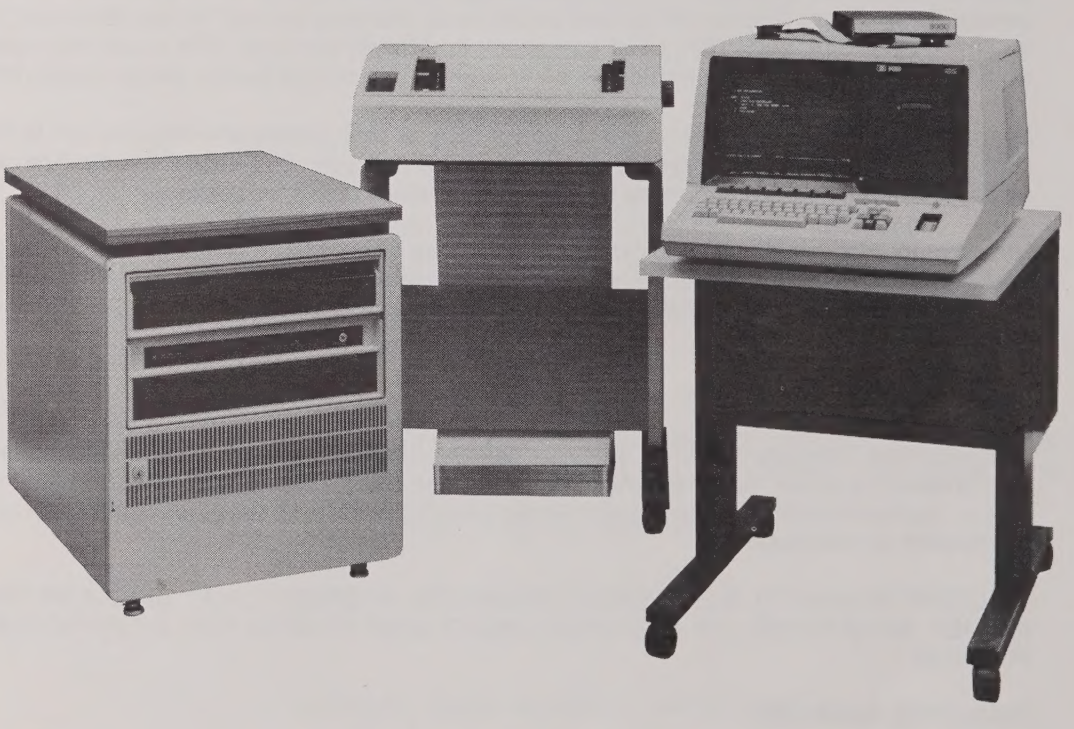
64000 LOGIC DEVELOPMENT SYSTEM



MODEL 64500A
POSITIVE PROM PROGRAMMER

HEWLETT PACKARD